

## CASE REPORTS

## VARIATIONS OF THE BRACHIAL PLEXUS (A CASE REPORT)

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### ABSTRACT

We have described a rare triple variation of the musculocutaneous nerve: atypical and late origin, and the unusual location of the nerve in the upper arm. Musculocutaneous nerve does not derive from the lateral cord of the brachial plexus, but from the median nerve 5-6 cm distally from the point of its formation, then it does not penetrate through coracobrachial muscle, but runs between it and biceps muscle, sending branches for its both heads. Then the nerve runs laterally and distally between biceps muscle and brachial muscle, following its typical movement to the lateral side of the arm. In its course the nerve derives motor branches to the coracobrachial, brachial and biceps muscles. Then the nerve pierces the deep fascia on the tendon of the biceps muscle and continues as the lateral cutaneous nerve of the forearm.

Variations in separation and placement of the branches of the lateral cord of the brachial plexus are frequent and important for clinical practice and must be well known and studied.

Knowledge not only for typical but also for atypical anatomy of the arm would substantially reduce errors in surgery of these areas and possible complications with bad results for patient and society.

In the available literature we did not encounter a description of low origin of musculocutaneous nerve, like our case, although some authors mention a possible variability in the origin of this nerve.

**Keywords:** *musculocutaneous nerve, variation, lateral cutaneous nerve of the forearm, surgery of the arm*

### INTRODUCTION

The ventral branches of the spinal nerves form plexuses in the cervical, lumbar and sacral regions. The brachial plexus is formed by the union of the ventral branches of the C5-Th1. The fifth and sixth rami pass by the medial scalenus muscle and form the upper trunk of the plexus. The anterior branch

of the seventh spinal nerve continues as middle trunk, and the eight cervical and first thoracic form behind posterior scalenus muscle the lower trunk of the brachial plexus. The trunks divide in an anterior and a posterior part. The anterior parts of the upper and middle trunks form the lateral cord, the anterior division of the lower trunk forms the medial cord and all posterior parts unite to posterior cord of the brachial plexus.

The musculocutaneous nerve (MCN) is an infraclavicular branch of the brachial plexus (BP). It derives from the ventral branches of the fifth, sixth and seventh cervical nerves. Usually it arises from the lateral cord of the brachial plexus (Fig. 1) above the lateral root of the median nerve, pierces the coracobrachial muscle and runs between the biceps and the brachial muscles down and laterally. After the reaching the lateral side of the arm the nerve

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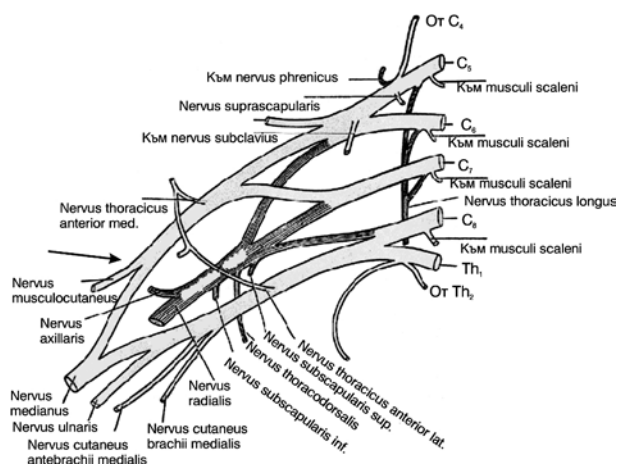
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pierces the deep fascia on the tendon of the biceps muscle and continues as the lateral cutaneous nerve of the forearm. Its sensibility area is the skin of the distal half of the forearm (Latarjet et al., 1967).



*Fig. 1. A schematic representation of the three cords of a right brachial plexus and their branches. The arrow indicates the normal location of the origin of the MCN from the BP*

Too many variations of the musculocutaneous nerve and its branches are described. Guerri-Guttenberg and Ingolotti (2009) describe the nerve absences in 1.2%, but connections to median nerve (MN) near the point of entry of the MCN into coracobrachial muscle are in 53.6% of their examinations.

According to Choi et al. (2002) connections between the musculocutaneous and median nerves in the arm are 46.4% but Loukas and Aqueelah (2005) report for 63.5% of the same variations.

Prasada and Chaudhary (1997) describe two cases (8.0%) of absent musculocutaneous nerve and the median nerve take over the area of supply of the MCN by giving both the muscular and sensory branches.

Fregnani et al. (2008) report about triple communication between MCN and MN with clinical-surgical implications.

Maeda et al. (2009) describe distributions of the MCN fibers of the communications to MN into four types. Type A, the nerve fibers reached the thenar muscles and the lateral digital nerves. In Type

B, they reached the pronator teres or flexor carpi radialis muscles in addition to Type A. In Type C, they reached the anterior interosseous nerve area in addition to Type B. Finally in Type D, they also reached the distal muscle belly of the index of the flexor digitorum superficialis.

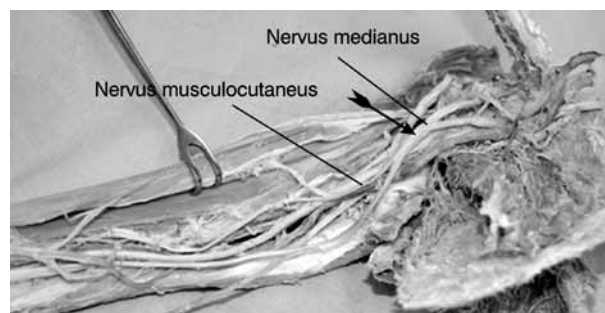
In the available literature we did not encounter a description of low origin of musculocutaneous nerve, like our case, although some authors (Eglseder and Goldman, 1997) mention a possible variability in the origin of this nerve.

## MATERIAL AND METHODS

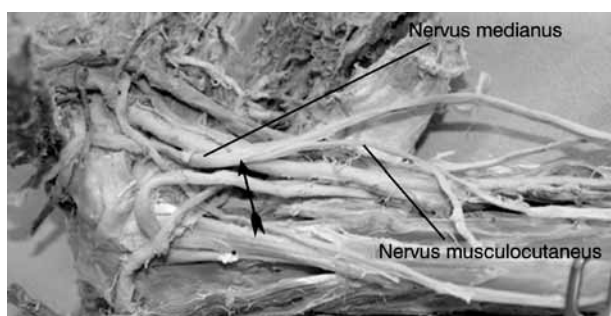
A case of late separation and disposal of aberrant musculocutaneous nerve is described. It is discovered during dissection exercises with medical students. For preparation of the material we used one-sided lancet and an anatomical pairs of nippers. Detected variations are documented in a series of photographs. The material is from cadaver of 78-year-old woman died of acute heart failure. The variation is on the right limb only.

## RESULTS

Musculocutaneous nerve does not derive from the lateral cord of the brachial plexus, but from the median nerve 5-6 cm distally from the point of its formation (Fig. 2), then it does not penetrate through coracobrachial muscle, but runs between it and biceps muscle, sending branches for its both heads. Then the nerve runs laterally and distally between biceps muscle and brachial muscle (Fig. 3), after which it follows its typical movement to the lateral side of the arm. In its course the nerve derives motor



*Fig. 2. A „low“ origin of musculocutaneous nerve. The arrow indicates the location of the separation of musculocutaneous nerve from the median nerve. It is visible a motor branch that goes to the head of the biceps muscle too*



*Fig. 3. The same case, but shown from another angle. The separation of musculocutaneous nerve from median nerve is apparent. The arrow indicates the site of release*

branches to the coracobrachial, brachial and biceps muscles. Then the MCN pierces the deep fascia on the tendon of the biceps muscle and continues as the lateral cutaneous nerve of the forearm.

## DISCUSSION

We described a triple variation of musculocutaneous nerve: atypical and late origin, and unusual location of the nerve in the upper arm. According Guerri-Guttenberg&Ingolotti (2009) the likes of not typical origin of the MCN occurs in less than 2% of all cases and in 11.1% the nerve does not pass through coracobrachial muscle.

Uysal et al. (2009) deem that in 83.6% of cases only one branch to the biceps muscle is given, which bifurcates in both heads of the biceps, and in 4.3% only there are two distinct branches to each of the muscle heads. According to the same authors in 3% of cases musculocutaneous nerve did not pierce coracobrachial muscle.

Described by Prasada & Chaudhary (2001) in 20.7%, and according to Budhiraja (2011) in 33% of cases, a connection between the musculocutaneous nerve and median nerve is missing here.

Choi et al. (2001) indicate that in 46.4% of their corpse material studies variations of musculocutaneous nerve and median nerve, as follow: merge of both nerve - 19.2%, availability of more than two additional connecting branches between them - 72.6% and connecting only two branches - 6.8%. Similar results are published by Venieratos & Anagnostopoulo (1998).

According to Beheiry (2004) in 1.7% of cases investigated by him, brachial muscle and both heads of the biceps muscle are supplied by motor branches of

the median nerve, and in all cases musculocutaneous nerve is missing.

Regardless of the percentage differences among the different authors, all indicate that the most common variation of branches originating from the lateral cord of the brachial plexus is the presence of connecting branches between the median nerve and musculocutaneous nerve. Second in frequency are variations in the location of the musculocutaneous nerve, and motor innervation of the arm flexor muscle group. In the available literature we did not encounter a description of low origin of musculocutaneous nerve, like our case, although some authors mention a possible variability in the origin of this nerve.

## CONCLUSIONS

1. Variations in separation and placement of the branches of the lateral cord of the brachial plexus are frequent and important for clinical practice and must be well known and studied.
2. Knowledge not only for typical but also for atypical anatomy of the arm would substantially reduce errors in surgery of these areas and possible complications with bad results for patient and society.

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